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The second record of *Cryphaeus cornutus* (Fischer de Waldheim, 1823) in Slovakia and its possible expansion in Central Europe (Coleoptera, Tenebrionidae)

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Abstract
The first record of *Cryphaeus cornutus* (Fischer de Waldheim, 1823) in western Slovakia represents the second report from the country. The new locality is a on the northern edge of the distributional range of the species. The possible expansion of the species in Central Europe is discussed based on the recently published records.

Keywords
Darkling beetles, distribution, faunistic, project LIFE12, range

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Introduction

In recent decades, range expansion of several thermophilous invertebrates has been observed in Central Europe. Some of the best-known examples are *Mantis religiosa* (Linnaeus, 1758) and *Agriope bruennichi* (Scopoli, 1772) (Liana 2007; Janšta et al. 2008; Kumschick et al. 2011). One of the species that also seems to be expanding its range is a darkling beetle, *Cryphaeus cornutus* (Fischer de Waldheim, 1823) (Fig. 1). This sporadically found mycetophagous beetle was originally described from the Caucasus and subsequently reported from the Middle East, Asia Minor, and southern Europe. For a long time, the only known records from Central Europe were from Hungary, but recently, it has been also reported from Slovakia (Gabzdil 2014). We present the second record of this species from Slovakia and discuss its distribution and possible expansion in Central Europe.

Methods

We collected three specimens (one male and two females) near Virt village in south-western Slovakia during long-term entomological research. Beetles were collected under bark of a wooden fence made of thin logs (Fig. 2). Specimens were killed with ethyl acetate and dry-mounted on cardboard. The habitus photography was made with Zeiss Axio-Zoom V-16 stereomicroscope with Canon 5D Mark IV camera attached and using diffuse LED lighting. Images were stacked using Zerene Stacker 1.04 and edited in Adobe Photoshop CC. The map was created in QGIS 3.10.2 using a basemap from http://www.naturalearthdata.com and edited in Adobe Illustrator CC. The specimens were identified using the key by Novák (2014). The nomenclature follows Löbl et al. (2008). The examined material is deposited in the collection of Department of Zoology, Faculty of Natural

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Figure 1. Habitus of *Cryphaeus cornutus* (Fischer de Waldheim, 1823), male. Scale bar = 1 mm.

Sciences, Comenius University in Bratislava, Slovakia (DZCU).

Results

Family Tenebrionidae Latreille, 1802
Subfamily Tenebrioninae Latreille, 1802
Tribe Toxicini Oken, 1843
Genus *Cryphaeus* Klug, 1833

Cryphaeus cornutus (Fischer de Waldheim, 1823)

New record. SLOVAKIA • 1 ♂, 2 ♀♀; Virt village env.; 47°45′51″N, 018°20′21″E, 115 m a.s.l.; 8 Aug. 2018; Samuel Krčmárik leg.; under bark of a wooden fence made of thin logs; DZCU.

Identification. *Cryphaeus cornutus* is one of the two species of the tribe Toxicini known from the Western Palaearctic, and it is the only species occurring in Europe (Löbl et al. 2008; Novák 2014). The body is oblong, entirely black, and 10–12 mm long. Males of *C. cornutus* are distinctive due to the presence of two long,

Figure 2. Habitat of *Cryphaeus cornutus* (Fischer de Waldheim, 1823) near Virt village in south-western Slovakia, 47°45′51″N, 018° 20′21″E.

horn-like processes on the head (Novák 2014) (Fig. 1). The overall appearance is similar to some members of the tribe Tenebrionini, but *C. cornutus* may be distinguished on account of its three-segmented antennal club (Fig. 1) and divided eyes. The only congener occurring in the Western Palearctic, *Cryphaeus laticeps* Lillig, 2006, is endemic to the Levant and differs from *C. cornutus* in having a four-segmented antennal club (Lillig 2006). The distributional ranges of the two species do not overlap.

Discussion

Cryphaeus cornutus is so far known from 16 countries in the Western Palearctic: Canary Islands (Spain), France, Slovenia, Bosnia and Herzegovina, Slovakia, Hungary, Romania, Bulgaria, Greece, Ukraine, Russia, Cyprus, Turkey, Syria, Georgia and Azerbaijan (Löbl et al. 2008). The origin of the French populations is uncertain and has already been discussed: while Dalmon (1993) considered them to be introduced, according to Merkl (in Dalmon 1993) they may be indigenous. In Poland, one individual was caught in the Kraków Botanical Garden in 1937, but the specimen was probably introduced (Iwan et al. 2010). No other specimen has been found in Poland since then, and the species is not considered part of the Polish fauna (Stebnicka 1991; Iwan et al. 2010). Until recently, the species has been so far known in Central Europe only from Hungary. During the first half of the 20th century, *C. cornutus* was only reported from southwestern Hungary and was considered rare. In 1996 it was recorded on the Great Hungarian Plain for the first time (Merkl 1998). After 2000, it was also found at several localities in northern Hungary such as Nagymaros, Túristvándi, and around Budapest (Kovács and Németh 2010) (Fig. 3). In Hungary, the species seems to prefer hills and is rarely found in lowlands (Kovács and Németh 2010).

In Slovakia, *C. cornutus* was recorded for the first time in 2011 near Zalužice village in eastern Slovakia (Gabzdil 2014). Additional specimens were collected at

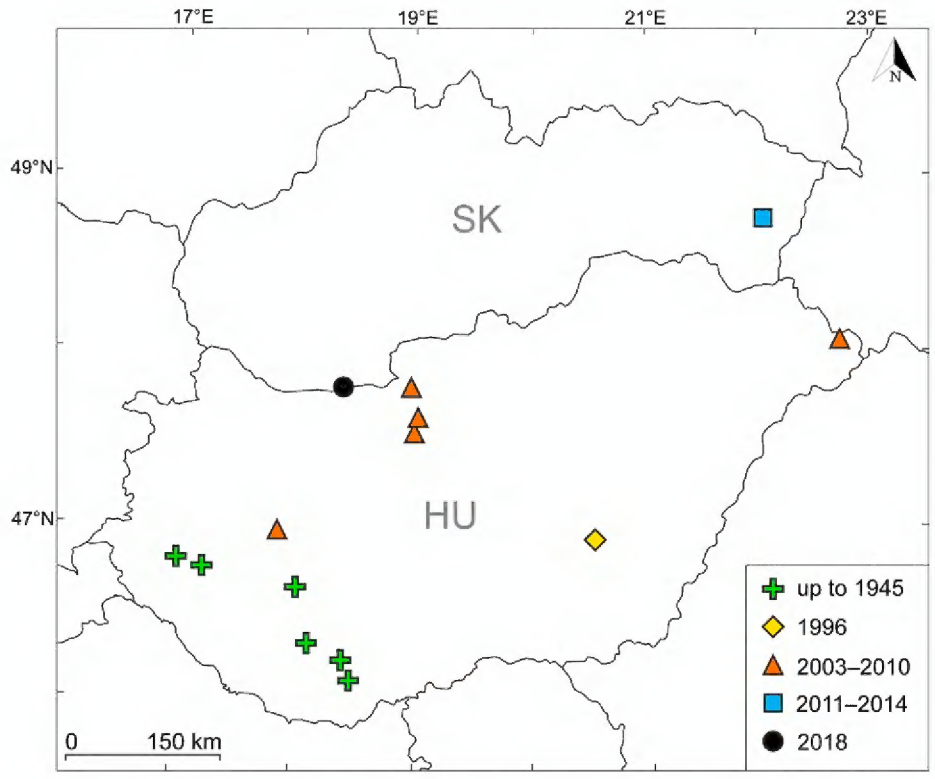

Figure 3. Distribution of *Cryphaeus cornutus* (Fischer de Waldheim, 1823) in Hungary and Slovakia. Green crosses represent the historical records summarized in Merkl (1998); yellow rectangle represents the record from 1996 published by Merkl (1998); orange triangles represent the records published by Kovács and Németh (2010); blue square represents the record by Gabzdil (2014) and black circle represent the recent record. Abbreviations: HU = Hungary; SK = Slovakia.

the same locality in the following years on the trunk of a cherry tree (*Prunus* sp.) and on poplar trees (*Populus* sp.). Our recent find represents the first record of *C. cornutus* in western Slovakia and the second report from the country. The newly reported locality is is a on the northern edge of the distributional range of the species. This locality, on the northern part of the Pannonian Plain, is nearly 300 km west of the only other known Slovak locality and about 40 km from the closest known Hungarian locality (Fig. 3). We collected our specimens near human settlement surrounded mostly by cultivated fields and a sand dune used for pasture. The trees surrounding the collection site are almost exclusively the invasive ones: *Acer negundo* L., *Ailanthus altissima* (Mill.) Swingle, *Robinia pseudoacacia* L., and *Gleditsia triacanthos* L. Even though the possibility that *C. cornutus* has been present in Slovakia for a longer time cannot be fully excluded, it seems unlikely that such a remarkable species would remain unnoticed, especially in southwestern Slovakia which has been of high interest of both professional and amateur entomologists. In the context of increasing findings in northern Hungary, Slovak populations seem to be of natural origin rather than being introduced. Recent data from Hungary and Slovakia suggest the northward expansion of the species, but further data are needed to confirm this hypothesis.

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Authors' Contributions

SK collected the specimens and wrote the manuscript. DS and JK prepared the photographs and wrote the manuscript.

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